THE AIRCRAFT ENGINEER

No. 155. (Volume XVI No. 12) 13th Year December 29, 1938

AN AIRCRAFT ENGINEER in PARIS

The 1938 Aero Show Reviewed

By H. J. POLLARD, Wh.Ex., F.R.Ae.Soc.

THE first impression of the major exhibits in the Grand Palais on the occasion of the Sixteenth *Salon de l'Aviation* was one of disappointment. The lack of what might be termed " new development " was the most striking feature of the Show, apart from such points as the various high-lift devices of certain machines on the Polish stand and the retractable tricycle undercarriage on the Fokker D 23. It became evident that the only way in which the visit could be made profitable would be by close scrutiny and considerable questioning on the stands.

On entering the show the first exhibit one noticed was the Morane-Saulnier 406 single-seater fighter. A brief description of this machine was published in the issue of *Flight* of December 1. A sample of spar construction on the stand attracted attention ; it does not appear to have been described previously. A view of the construction is shown in Fig. 1, the method of securing webs to flanges being illustrated in Fig. 2. While there is nothing unique in the spar itself, some of the details are unusual. The flange is of the well-known π section as incorporated in several of the Short designs. The most noticeable feature of the spar is the continuity of the root-end with the main length of the top and bottom flanges ; that is to say, each flange is machined from a single piece of steel.

It is, I think, the invariable custom of British designers to have a separate end-fitting for flange attachment, the obvious reason being that an enormous amount of machine work is thereby saved. To machine a flange continuously from end to end is not uncommon in British designs ; a considerable amount of scrap material is usually entailed, but to have sufficient sectional area available to allow of the end-fitting also being machined from the solid appears to be asking a little too much. If it is considered desirable to have the end lug integral with the main section, then it would appear reasonable to have the end " upset " or " jumped " to a larger section, through endwise pressure ; special forging equipment would, however, be required.

The easiest solution is to have a short end-fitting bolted to the spar flange, but the possible reduction in strength, due to the amount of material removed from the flange for the purpose of bolting, is sometimes a nasty problem for the structural designer. The localisation of stresses at the place in the wing where these things are least desired may be another troublesome aspect. These difficulties are usually made good through local reinforcements. It certainly seems desirable that, in the event of an end-fitting being damaged through bad drilling, over-reaming or the like, the fitting only should be scrapped and not the complete flange. There is, of course, a great deal to be said for the use of high-tensile steel for such parts as spar flanges, providing reasonable change of section can be achieved. Other features of the spar are shown in Fig. 1. The use of internal diagonal shear members seems scarcely necessary. Surely the two continuous plate webs, designed according to the tension diagonal theory, combined with vertical stiffeners as shown in the sketch, should be sufficient. Such a spar should be lighter and cheaper than one with diagonal shear members.

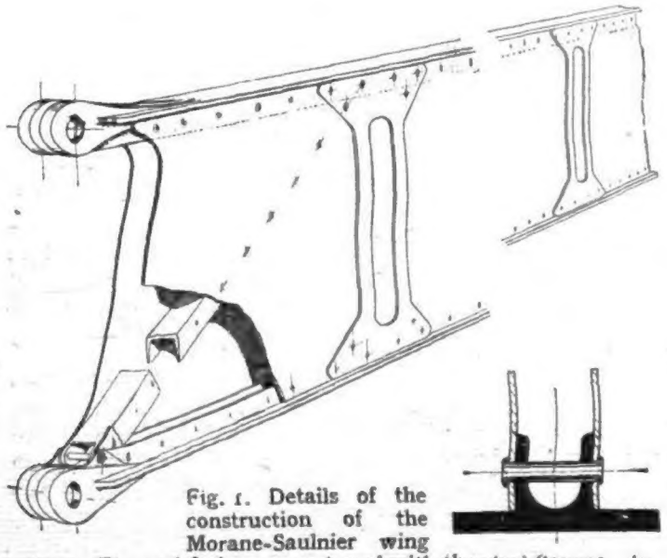

Fig. 1. Details of the construction of the Morane-Saulnier wing spar. The end fittings are integral with the steel flanges. In Fig. 2, on the right, is shown the method of attaching the webs to the flanges of the spar.

Slots and Flaps

Full of interest were the exhibits on the Polish stand. For example, all the monoplane wings were fitted with slots, automatic or manually operated, as on their Army co-operation machine, the " Mewa." This machine has the remarkable speed range of approximately 5 to 1. Such, in fact, is the landing angle of the aircraft at minimum speed, due to the blanking effect of the wing on the tail-plane, that the innermost length of the wing trailing edge has had to be specially up-tilted to render the tailplane operative. Even the ailerons were flapped, and it was amazing to hear that the lateral control was unaffected when the flaps were operated. On this, as on so many of the other exhibits, the twin-rudders were a distinctive feature. Apparently some store is set by the increased aerodynamic effectiveness of the tailplane through the elimination of the tip losses arising from the normal three-dimensional air flow. The gain through this arrangement is assessed at 12 per cent.

One eminent designer said that he preferred this layout because it was structurally more simple than the normal central placing of the fin ; the reason being that the fin